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Creating Exploratory Touch-screen Games that Include Novel and Surprising Aspects as Motivators of Communication for Children with Autism

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OVERALL GOAL: To investigate design strategies for technologies for ASC, specifically how to motivate children's communication within, and around, touch-screen games.

Background

- Unpredictability and "lack of sameness" are frequently stressful for children with ASC [1].
- Work with the ECHOES virtual environment for ASC suggests that **novel and surprising aspects (i.e. discrepancies)** of a technology can be experienced as **interesting, positive motivators of communication** when balanced with substantial sameness [2].
- ECHOES activities [3] introduced novel elements, and **unplanned software issues meant that the system intermittently appeared to make "mistakes"** (e.g. executing the "wrong" actions with respect to activity goals/rules or to object properties)
- **Children frequently and spontaneously initiated to social partners about discrepancies, opposite to what ASC literature might predict [2].**
- Subsequent analyses of child-ECHOES interactions, combined with "lessons learned" from school studies, have identified characteristics that may have allowed discrepancies to be perceived as motivating but still emotionally manageable [4].

ECHOES results suggest a **NEW DESIGN STRATEGY:** deliberately including novel and expectation-violating aspects in games as a way of motivating children's communication.

Design principles

Design principles, largely derived from ECHOES, are intended to support transfer of "motivating but manageable" discrepancies to new contexts [4] by:

- Establishing clear child **expectations** and maintaining **integrity** of the environment and activities,
- Ensuring **flexibility** and **resolvability** of child-system interactions (choice of actions, no "dead ends")
- Offering wide **variety** of discrepancies at an appropriate **frequency**, so as to interest all children.
- Posing **ambiguous** opportunities for communication, rather than demanding specific behaviours or communicative forms.

Game Design Overview

Mini-games structure child-system and child-adult interactions, provide a shared focus and experiences about which to communicate

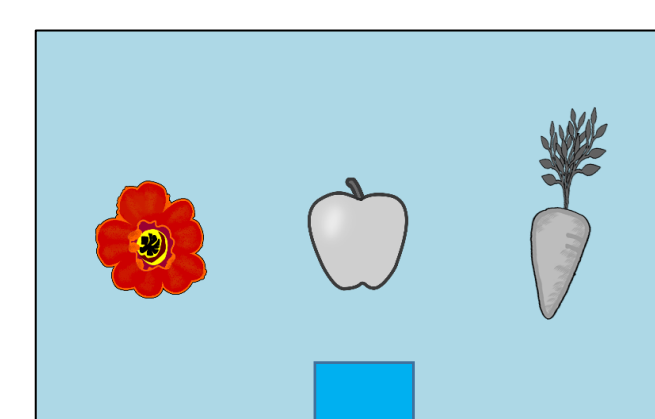
- Current games are **NOT educational** or "skill-building"; participation, goal completion are not inherently valuable.
- Each mini-game has **one main goal**, repeated actions
- Games are **simple and sensory** with **limited, repetitive language; non-competitive** with lots of positive feedback;
- Games use **simple touch-screen actions** only (e.g. No double-touches, pinching).

Over multiple sessions of play, mini-games establish, and then violate, child expectations about their contents. [SEE RIGHT]

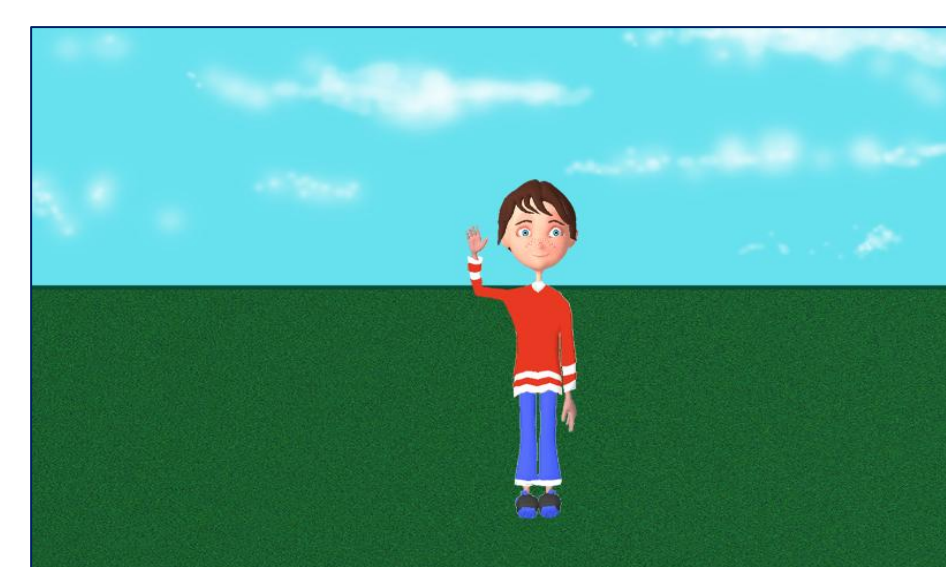
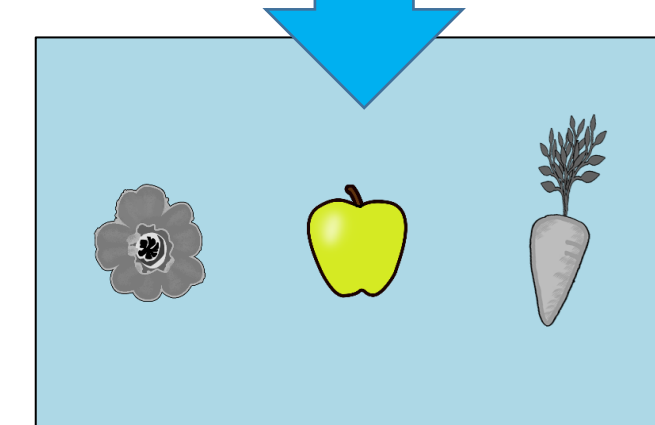
- **Multiple exposures** to the "normal" game version allow a child player to **develop expectations** about its patterns and behaviours.
- When expectations are established, the game can be **disrupted** (e.g. adding, subtracting, or changing aspects), offering the child an **opportunity to notice and communicate about things s/he thinks are novel, or that violate expectations**

"Sameness" of content *around* mini-games helps to structure games sessions, ensure novel, surprising aspects are "motivating but manageable"

- **Hello/Goodbye** scenes help signal transitions, and are exactly the same in every games session.
- **Menus** (left) are like a **visual schedule**, make clear which activity is being played now and next.



Hello /goodbye scene with Andy.



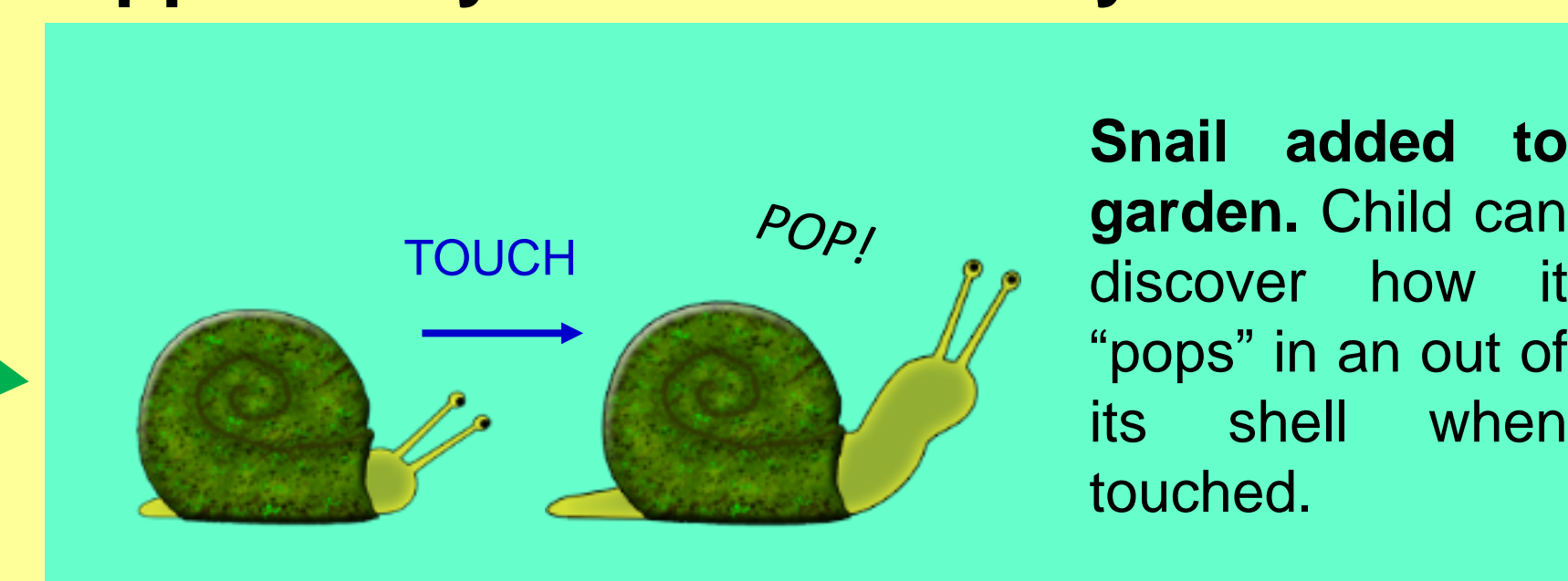
Child plays "normal" version of Flower games, developing expectations about it



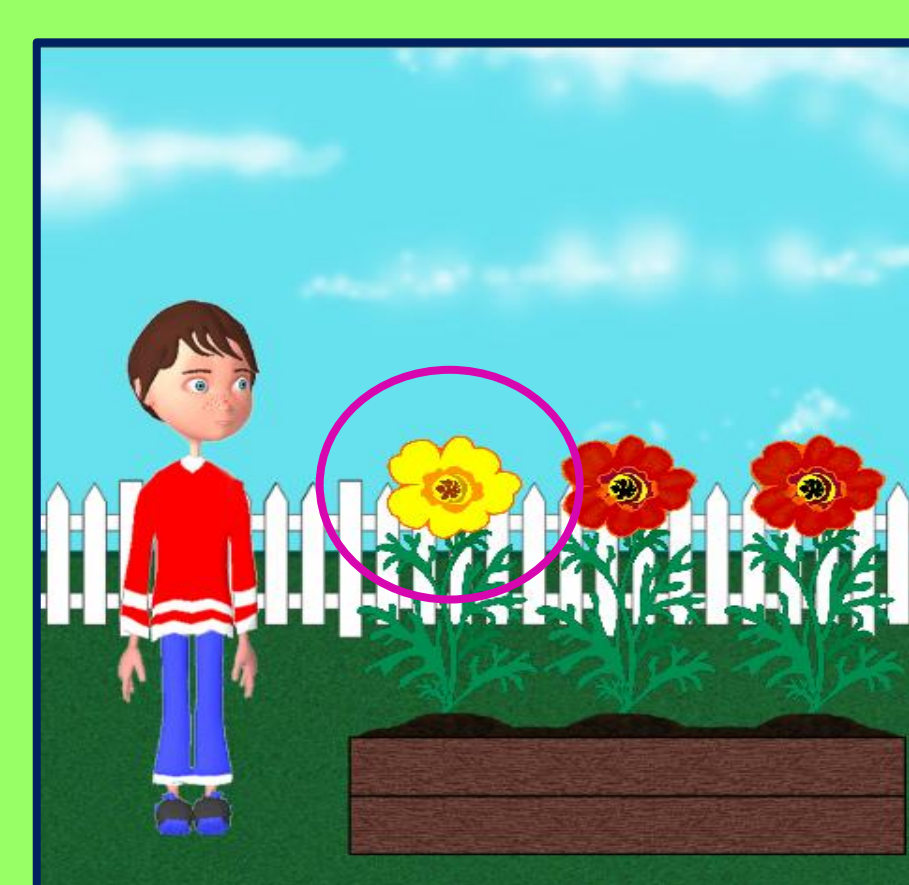
Child touches the "magic cloud" to grow flowers, and is rewarded by visual and sound effects. Andy can demonstrate the activity and gives positive feedback.

Later, child plays "discrepant" game versions, and has opportunity to notice and communicate about added, subtracted, and/or changed elements

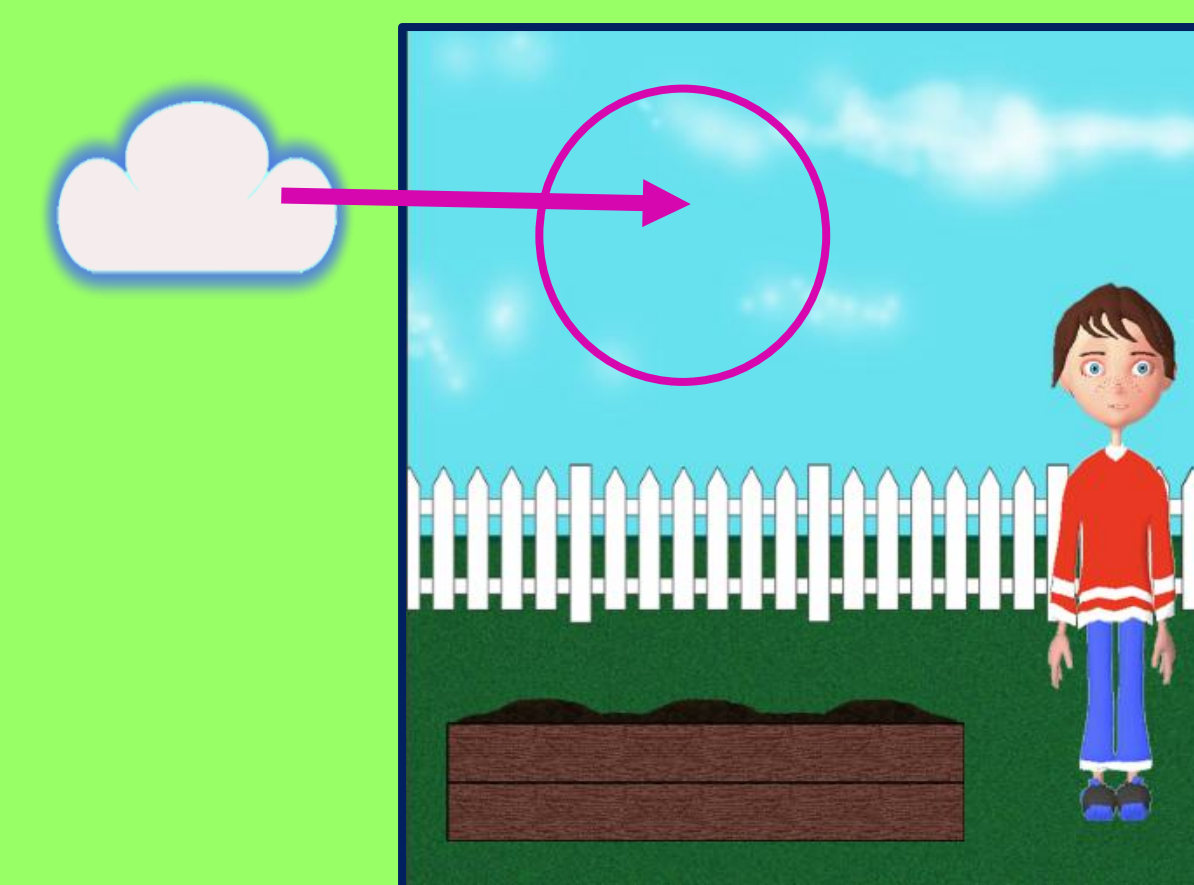
Opportunity to detect novelty



Opportunities for surprise (expectation-violation)



Colour change. Growing one yellow flower departs from established pattern (3 red).

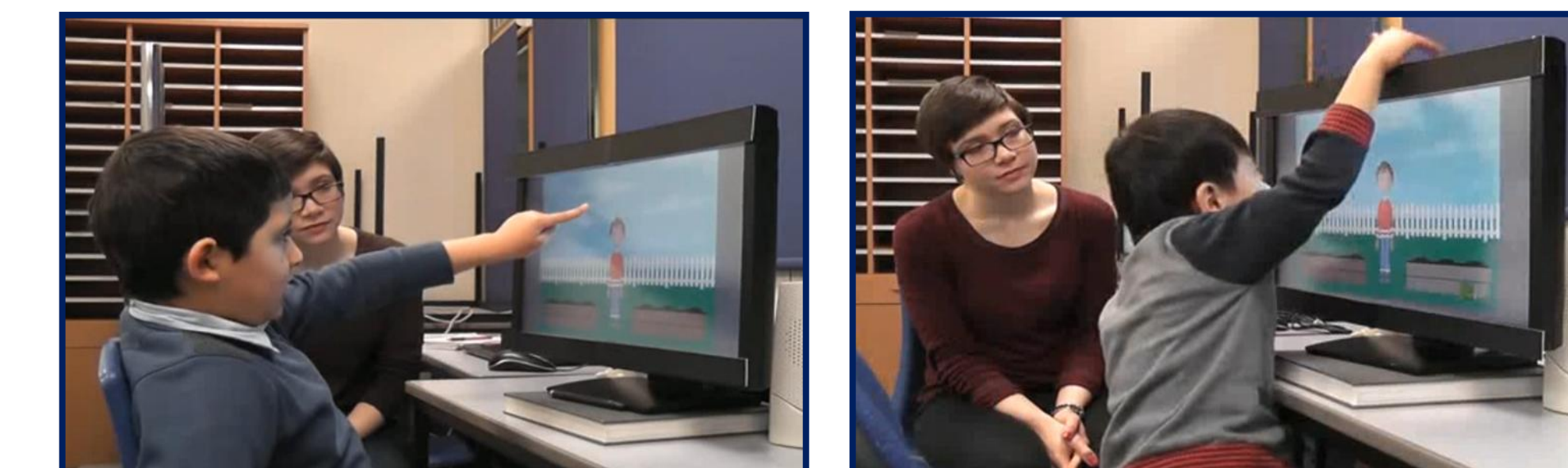


Missing cloud at activity start, when it was always present before. After a few seconds, cloud glides in so child can play.

Proof-of-concept Study

- **12 children** with ASC (10 M, 2 F) participated in a study in a **UK special school** during Spring 2015
- Children were developmentally 3-7 years old (per BPVS), with phrase-level language
- Children completed **3-4 games sessions**, playing the "normal versions" on day 1, and different discrepant versions on days 2 and 3.
- **Video recordings** of sessions will be **annotated for children behaviours**. Which design elements did they notice? How did they react? Did they initiate?

EXAMPLE: Children react to "missing cloud"



Right: Child immediately touches screen where cloud should be, then asks researcher where it is.

Left: Child asks researcher "Where's a cloud?", then watches screen corner closely until it returns.

VIDEO ANALYSIS (in progress) aims to evaluate the success of the design strategy and individual game aspects at motivating communication, *not* child success at "finding" novel or surprising aspects.

References

- [1] DSM-5: *Diagnostic and Statistical Manual of Mental Disorders*. American Psychiatric Association, Washington DC. (2013)..
- [2] Alcorn, A.M., Pain, H., & Good, J.[4] Alcorn, A.M., Pain, H., & Good, J. (2013). Discrepancies in a virtual learning environment: something "worth communicating about" for young children with ASC? Proc. of the Intl. Conf. on Interaction Design and Children (IDC '13, New York).
- [3] Porayska-Pomsta, K., Frauenberger, C., Pain, H. et al., (2012). Developing technology for autism: an interdisciplinary approach. *Personal and Ubiquitous Computing*, 16(2):117-127
- [4] Alcorn, A.M., Pain, H., & Good, J. (2014). Motivating children's initiations with novelty and surprise: Initial design recommendations for autism. Proc. of the Intl. Conf. on Interaction Design and Children (IDC '14, Aarhus, Denmark).

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